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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/829,660	04/22/2004	Apparao M. Rao	CXU-406	6822
22827	7590	12/27/2005	EXAMINER	
DORITY & MANNING, P.A. POST OFFICE BOX 1449 GREENVILLE, SC 29602-1449			RAETZSCH, ALVIN T	
			ART UNIT	PAPER NUMBER

1754

DATE MAILED: 12/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/829,660

Applicant(s)

RAO ET AL.

Examiner

Alvin T. Raetzsch

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) 26-33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-25 is/are rejected.
- 7) ☒ Claim(s) 7 is/are objected to.
- 8) ☒ Claim(s) 1-33 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
- Paper No(s)/Mail Date 7/15/04-9/7/04.

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-25, drawn to a process, classified in class 423, subclass 447.3.
- II. Claims 26-33, drawn to a product, classified in class 423, subclass 447.2.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by treating an existing nanotube with a catalyst and hydrocarbon.

3. Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Christina Mangelsen on 12/5/05 a provisional election was made with traverse to prosecute the invention of the process, claims 1-25. Affirmation of this election must be made by applicant in replying to this Office action. Claims 26-33 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

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6. Claims 1- 4, 6, & 14 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Baker et al. (US 5,618,875) in view of Hong et al. (US 2002/0127170 A1).

Claims 1-4 & 6: Baker teaches a process for making branched carbon nanotubes using an unsupported metal catalyst consisting of iron, copper, and titanium (Column 4), heating the catalyst in the presence of a carbon source, and growing nanotubes on the metal catalyst. Although the current disclosure claims a catalyst comprising 2 metals, it does not exclude the inclusion of a third.

Baker also teaches the vaporization of the catalyst precursor and using organic solvents such as benzene as the carbon source. Although Baker, when teaching the previous statement, is discussing a supported catalyst, this method could also be used for the unsupported catalyst production.

Claim 14: Baker teaches a reaction temperature of 500-700°C (Column 5).

In the event that Baker does not sufficiently teach the catalyst precursor vaporization method, Hong teaches making an unsupported catalyst for making nanotubes by vaporizing the catalyst precursor. It would have been obvious to someone of ordinary skill in the art to combine multiple precursors as taught by Baker, vaporize them according to Hong, and grow nanotubes on the resulting unsupported catalyst in order to provide a catalyst for the desired nanotube growth.

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7. Claims 5, 12-13, 15-16, 17-20, & 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker et al. (US 5,618,875) in view of Hong et al. (US 2002/0127170 A1).

Claim 1 is rejected with respect to Baker and Hong as stated above.

Claims 5 & 19: Hong teaches ferrocene, Baker does not. It would have been obvious to someone of ordinary skill in the art to use ferrocene as a precursor in Baker's process, as it has become a popular and readily available precursor in iron catalyst production.

Claims 12-13 & 24: A vaporization temperature is not taught by Baker or Hong, but it is obvious to optimize the temperature in order to get complete vaporization of the materials. In re Boesch, 617 F. 2nd 272, 205 USPQ 215 (CCPA 1980).

Claims 15-16: Combining the catalyst and carbon source during or after the catalyst materials are heated to the reaction temperature is a choice of sequence of steps and is a case of prima facie obviousness.

Claims 17, 18 & 20: Baker teaches a process for making branched carbon nanotubes using an unsupported metal catalyst consisting of iron, copper, and titanium (Column 4), heating the catalyst in the presence of a carbon source, and growing nanotubes on the metal catalyst. Although the current disclosure claims a catalyst comprising 2 metals, it does not exclude the inclusion of a third.

Baker also teaches the vaporization of the catalyst precursor and using organic solvents such as benzene as the carbon source. Although Baker, when teaching the

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previous statement, is discussing a supported catalyst, this method could also be used for the unsupported catalyst production.

Hong teaches making an unsupported catalyst for making nanotubes by vaporizing the catalyst precursor. It would have been obvious to someone of ordinary skill in the art to combine multiple precursors as taught by Baker with the organic solvent, vaporize them according to Hong, and grow nanotubes on the resulting unsupported catalyst in order to provide a catalyst for the desired nanotube growth.

Claim 25: Baker teaches a reaction temperature of 500-700°C (Column 5).

8. Claims 8-11 and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker et al. (US 5,618,875) in view of Hong et al. (US 2002/0127170 A1) as applied to claims 1 & 17 above, and further in view of Komatsu et al. (US 4,816,289).

Claims 8-11 & 21-23: A ratio of titanium to iron of 2-3:1 is taught by Baker (Column 4) and is further obvious to optimize. An amount of the catalyst relative to all of the reactants is not explicitly taught by Baker or Hong, but values of about 0.5-5% can be inferred by the teachings of Baker. Komatsu, however, teaches using 0.01-5% of a transition metal catalyst relative to the carbon source to make nanotubes (Claim 1). It would have been obvious to use the amount of catalyst relative to reactants taught by Komatsu in the process taught by Baker in order to optimize nanotube growth on a transition metal catalyst.

Allowable Subject Matter

9. Claim 7 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter: The use of tetrakis(diethylamino)titanium as a titanium precursor in catalyst does not appear to be taught by the prior art.

In addition, the claims would be allowable if claims 1 & 17 were amended to include the following limitations:

Iron as the catalyst;

Titanium, zirconium, or hafnium as the dopant; AND

That the catalyst particle is limited to only TWO metals

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alvin T. Raetzsch whose telephone number is 571-272-8164. The examiner can normally be reached on 9-5 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ATR



STUART L. HENDRICKSON
PRIMARY EXAMINER